US ENVIRONMENTAL PROTECTION AGENCY
REGION 9

FACT SHEET FOR

CONCENTRATED ANIMAL FEEDING OPERATIONS (CAFOs) GENERAL PERMIT NO. AZG800000 FOR THE STATE OF ARIZONA

June 21, 2001

I. INTRODUCTION

A. Type of facility which is the subject of the permit:

The permit would cover CAFOs in Arizona and in Indian Country lands as set forth in Section II of the permit. The permit would establish effluent limitations, best management practices and other conditions governing the discharge of pollutants to waters of the United States from CAFOs in Arizona.

B. Type and quantity of pollutants which are proposed to be or are being discharged:

The permit provides that there shall be no discharge of waste, process wastewater, or process wastewater pollutants to waters of the United States except when storm events cause an overflow of process wastewater from a facility properly designed, constructed, maintained, and operated to contain all process generated wastewaters resulting from the operation of the CAFO, in addition to all contaminated runoff from a 25-year, 24-hour storm event. Under the permit, discharges of manure or process waste water from wastewater control or retention structures to waters of the United States by means of a hydrologic connection are prohibited. The permit also prohibits discharges which cause or contribute to the violation of a water quality standard (except with respect to certain discharges related to storm water runoff or return flows from irrigated agriculture).

II. REGULATORY BASIS FOR PERMIT CONDITIONS

A. Technology Based Limitations

The proposed permit includes technology-based effluent limitations and standards based on the effluent limitations guidelines for the Feedlots Point Source Category, 40 CFR 412. The permit also includes conditions designed to achieve water quality standards established under CWA, section 303, including Arizona's water quality criteria codified at Arizona Administrative Code Title 18, Chapter 11, and federally promulgated water quality standards codified at 40 CFR 131.31.

B. Best Management Practices and Best Management Practices Plan

Provisions requiring the use of best management practices (BMPS) to control or abate the discharge of pollutants are included in the permit pursuant to CWA, section 402(a)(1), 308(a), 304(e), and 501(a), and 40 CFR 122.43 and 122.44(k).

C. Discharge Monitoring Requirements and Standard Conditions

Monitoring requirements are included pursuant to 40 CFR 122.48 and 40 CFR 122.44(i). Conditions applicable to all permits under 40 CFR 122.41 are included pursuant to that regulation.

III. WATER QUALITY BASIS FOR PERMIT CONDITIONS

A. National Water Quality Impacts from Agricultural Sources

National data points to a major, continuing water pollution problem coming from agricultural sources, including CAFOs. Barry, 1998. Nutrient contamination from agriculture affects both ground water and surface water and dwarfs urban nutrient contributions. Trachtenberg, 1994. Phosphorous and nitrogen from agriculture constitute two of the most pervasive pollutants of U.S. surface and groundwater. Ogg, 1999.

Relying on state assessments conducted in 1990 and 1991, the U.S. General Accounting Office (USGAO) reported that, among five general categories of pollution sources (Municipal Point Sources; Urban Runoff/Storm Sewers; Agriculture; Industrial Point Sources; and Natural Sources), agriculture ranked as the number one cause of impaired rivers and streams and lakes. USGAO, 1995.

Reports by state environmental agencies indicate that 40% of the nation's rivers and streams assessed by states (which are only a small portion of all waters) fail to meet applicable water quality standards. Copeland, 1998. According to limited data submitted by states and compiled by EPA, agriculture is now the leading source of water quality impairments in United States rivers and lakes, affecting 60% of impaired river miles and 50% of impaired lake acres. Copeland, 1998. Feedlots are estimated to be the principal source of 16% of waters impaired by agricultural practices; they are the third leading agricultural source of water pollution, after non-irrigated crops and irrigated crop production. Copeland, 1998.

Livestock manures are considered to be significant pollutants of the nation's waters. Van Horn, 1994. On a national basis, run-off of sediment, pesticides, and nutrients such as phosphorous and nitrogen have been considered the greatest environmental threats to water quality posed by animal agriculture. Pell, 1997.

USGAO stated that non-point pollution from feedlots impaired about 9 percent of the river and stream miles assessed nationwide and about 25 percent of the miles impaired by agricultural non-point pollution. USGAO, 1995.

EPA statistics have indicated that CAFOs are responsible for approximately 26% of the surface water impairments caused by agricultural pollution. Thurow, 1997; Grover, 1996.

Statistical studies of water quality trends indicate that increases in in-stream loadings of nitrogen and phosphorous are, in part, strongly correlated with increases in the concentration of the livestock population in a watershed. USGAO, 1995.

As part of its National Water Quality Assessment (NAWQA), the U.S. Geological Survey (USGS) found that manure was a significant source of nitrogen and phosphorous inputs to the land areas of the 114 watersheds it studied using data compiled for these watersheds between 1980 and 1990. USGAO, 1995. Among the watersheds studied were 19 Western watersheds covering 8 percent of that region's land area. USGAO, 1995. NAWQA data indicated that manure was the second most important source of nitrogen and the leading source of phosphorous inputs in the watershed studied in the Western region; manure accounted for 39 percent of median inputs of nitrogen and 53 percent of median inputs of phosphorous in the Western watersheds studied. USGAO, 1995.

Using 1987 Census of Agriculture data and information from other sources of manure production and manure nutrient content, the U.S. Department of Agriculture's (USDA) Economic Research Service (ERS) estimated and mapped nitrogen from manure concentrations by county. USGAO, 1995. These concentrations are expressed as a ratio of the quantity of nitrogen from manure (in pounds) to the cropland acreage operated by livestock and poultry producers in each county. USGAO, 1995. The estimates show where nitrogen from manure is available as a crop nutrient; the estimates are not necessarily an indication of water quality problems or improper manure management. USGAO, 1995. These estimates indicate that the counties with the highest manure nitrogen concentrations per acre are generally located in the northeastern states; parts of the Southeast; Wisconsin; and southern California. USGAO, 1995. ERS's estimates of manure phosphorous concentrations per acre are distributed similarly to the estimates for manure nitrogen. USGAO, 1995.

Feedlots contribute to river and stream impairment as a result of animal waste runoff. USGAO, 1995. In Arizona, five out of twenty-one feedlots categorized as CAFOs have received a Notice of Opportunity to Correct (NOC) due to discharges. Arizona Department of Environmental Quality, 2001.

Animal waste runoff can introduce excess nutrients (such as nitrogen or phosphorous), organic matter, and pathogens. Hart, 1997; USGAO, 1995; Eghball, 1994; Sweeten 1994.

Comparisons of human community equivalents with the waste that herds produce are illustrative; for example, the manure produced by a dairy milking 200 cows contains as much nitrogen as the sewage of a community with 5,000 to 10,000 residents. Copeland, 1998.

Excess nutrient loadings can overstimulate the growth of algae. USGAO, 1995. The decomposition of organic matter requires oxygen that would otherwise be available for fish and aquatic animals. USGAO, 1995.

The phosphate concentration in surface water is one of two nutrients controlling growth of freshwater phytoplankton and is often considered to be the leading indicator of water quality in regard to eutrophication. Hart, 1997. The bioavailability of phosphorous in runoff is very important in that most freshwater systems are phosphorous limited when considering nutrients for algae growth leading to eutrophication problems. McFarland, 1999. The loss of agricultural phosphorous often leads to deterioration of water quality from accelerated eutrophication and can have significant off-site economic impacts. Sharpley, 1994. By the time these impacts are manifest, remedial strategies are often difficult and expensive to implement. Sharpley, 1994. Increases of phosphorous in drainage water from agricultural operations have the potential to substantially negate the benefits of removing phosphorous from other point sources. Sharpley, 2000.

Nitrogen and phosphorous from confined animal production were found to be responsible for contamination of surface water in Lake Okeechobee, FL, St. Albans Bay, VT, Tillamook Bay, OR, and Erath County, TX. Parsons, 1995.

Outbreaks of gastroenteritis have been traced to livestock operations. Pell, 1997.

Unless manure from livestock operations is handled appropriately, pathogens in the manure may infect other animals or humans. Pell, 1997. Wesley, 2000.

Dairy farms have been identified as reservoirs of *E. coli* O157:H7. Pell, 1997. Garber, 1999.

The National Animal Health Survey is a recently completed national study that includes data on *Giardia* and *Cryptosporidium parvum* in beef and dairy animals. Pell, 1997. More than 7300 dairy calves on 1100 farms were sampled. Pell, 1997. The data showed that *Cryptosporidium parvum* oocysts were found on 59% of the dairy farms and in 22.4% of the tested heifers. Pell, 1997. Comparable data were obtained for beef calves. Pell, 1997.

In a study of 31 milk cow dairy operations in various states, at least one cow positive for *Campylobacter jejuni* was detected on all the operations; 71% of the operations had at least one animal positive for *Arcobacter* spp. Wesley, 2000.

Pathogen contamination can result in restrictions on using waters for drinking water, or recreation such as fishing, swimming or boating. USGAO, 1995.

Farmers may manage manure and related wastes in different ways, depending on the characteristics of the farm operation and the physical conditions of the farm. Copeland, 1998. Waste management systems usually include several components. Copeland, 1998. Manure may be collected at temporary storage facilities until it can be treated or used. Copeland, 1998. Common storage facilities include stacks, ponds, and tanks. Copeland, 1998. Waste may be treated in many ways to convert it to a more useful resource, usually by concentrating the beneficial constituents and decreasing the total volume. Copeland, 1998.

Lagoons are the most common treatment facility. Copeland, 1998. Other types of treatment facilities include composters, solid separators, and settling basins. Copeland, 1998.

Many dairy lagoon systems in current use are mismanaged. Van Horn, 1994. Experts have noted a tendency to dispose of trash, waste feed, and spilled silage or hay by flushing them into the lagoon. Van Horn, 1994.

A large spill from a CAFO lagoon can substantially affect surface waters, and cause substantial economic losses. Burkholder, 1977 (analyzing 1995 swine waste spill in North Carolina; finding river area traversed by the plume, approximately 31 km in length, to be anoxic from surface to bottom except for one reading; noting that estimated loss from the spill for the recreational fishing industry alone was $4 million).

The most common use, by far, of waste generated at animal feeding operations is to spread it across farm fields as a soil amendment and a nutrient supplement. Copeland, 1998.

Application of nutrients to cropland in excess of recommended amounts occurs widely. Ogg, 1999; Sims, 2000. Part of this excessive use of nutrients results from lack of enough cropland on many farms producing livestock, but most is due to the difficulty of measuring and accounting for (or crediting) the farm produced nutrients when applying fertilizer. Ogg, 1999. Policies that support wider use of technologies for planning and providing fertilizer recommendations are producing economic gains, which could reach hundreds of millions of dollars, across various livestock sectors. Ogg, 1999.

Many large dairies have insufficient acreage for recycling nutrients and, thus, must haul manure nutrients to locations off the farm. Van Horn, 1994. Some dairies contract with nearby neighbors, who can utilize a portion of the dairy farm's manure in place of commercial fertilizer. Van Horn, 1994. In Arizona, some dairies and feedlots compost or sell manure to fertilizer companies.

Some farmers import and apply manure nitrogen far in excess of agronomic recommendations, especially when importing manure. Parsons, 1995; Trachtenberg, 1994. For example, within a Virginia study area, farms which imported manure were reported to have applied excess nitrogen and achieved nitrogen losses twice that of the average farm. Parsons, 1995. Surveys in Iowa indicated that only about half of farmers in that State account for the nutrient content of manure in terms of crop production. Trachtenberg, 1994. Redundant use of nutrients cause serious contamination of water, and studies indicate a widespread need for better crediting of nutrients. Trachtenberg, 1994. Researchers using USDA Farm Costs and Returns survey data found that nearly 7% of farm acres were in farms that have an excess of nitrogen from legumes and manure, and the nitrogen excess farms get over 80% of their non-fertilizer crop-available nitrogen from manure. Trachtenberg, 1994. Those researchers found that both beef and dairy cows are the largest producers of nitrogen (nearly 80% combined) on excess farms. Trachtenberg, 1994.

Farmers, themselves, are in many cases major beneficiaries of improved nutrient management. Ogg, 1999. At least one agricultural engineer has concluded that every livestock enterprise should develop a comprehensive waste management plan, and that a well-developed, well-executed waste management plan is one of the livestock producers's most valuable tools.. Safley, 1994.

Runoff loss occurs from the fields receiving the manure and contributes to pollution in surface waters. Eghball, 1994.

In areas where a large number of confined animal producers are located, the amount of nutrients in manure often exceeds local crop requirements and area of land available for application. Sharpley, 1994. Water quality can be negatively impacted by excessive application rates, poor timing and mismanagement of manure applications to cropland. Davis, 1997. Large nutrient loss may result from runoff events occurring shortly after application. Eghball, 1994. Excessive manure application rates to cropland have been related to nitrate buildups in soils and water supplies. Davis, 1997. The number of soils with plant-available phosphorous exceeding levels required for optimum crop yields has increased in areas of intensive agricultural and livestock production. Sharpley, 1994. Large dairies on relatively small land bases often accumulate nutrients in excess of crop use, and on many dairies enough nutrients have been added so that the soil can no longer hold them. Hart, 1997. Although phosphorous losses in runoff are generally less than 5% of applied phosphorous, dissolved phosphorous and total phosphorous concentrations often exceed critical values associated with excessive eutrophication. Sharpley, 1994.

A study of the North Bosque River watershed in Texas indicated that, as the percent of land area used for dairy waste application fields in a drainage basin increased, the concentration of nutrients in stormwater runoff increased. McFarland, 1999. In that study, the percent dairy waste application fields consistently had the strongest positive relationships with nutrient concentrations of any single land use variable, except for NH_3-N in which dairy cow density indicated the strongest positive correlation. McFarland, 1999. The study concluded that the stormwater runoff of nutrients from dairy waste application fields was indicated as the predominant source of nonpoint source nutrients impacting surface water quality in that watershed. McFarland, 1999.

Quantities of nutrients produced at confined animal operations nationwide rose about 20 percent in 1982-97, while acreage on livestock and poultry farms declined. Gollehon, 2000. Confined animals produced an estimated 1.23 million tons of recoverable manure nitrogen (collectible for spreading) in 1997, but 73 million acres of cropland and permanent pasture controlled by operators of confined livestock and poultry operations is estimated to have assimilative capacity for only 38 percent of the calculated nitrogen available. Gollehon, 2000. In 1997, about 72 percent of large operations had inadequate capacity to utilize all the nitrogen produced on-farm. Gollehon, 2000.

At least one researcher has concluded that, in the United States, the most important single remedy to address the environmental problems associated with excess nutrient application to cropland includes nutrient planning and using soil tests and other methods of avoiding excessive applications of fertilizer. Ogg, 1999.

B. Agricultural Water Quality Impacts Pertaining to Arizona

Arizona Department of Environmental Quality's "The Status of Water Quality in Arizona, Clean Water Act Section 305(b) Report 2000" ("Arizona 305(b) Report"), indicates that the top five probable sources impairing stream reaches were: natural sources, agriculture (including crop production and grazing practices), resource extraction, construction/land development and sources outside Arizona jurisdiction. ADEQ, 2000. The Arizona 305(b) Report also indicates that the top five probable sources impairing lakes were: natural sources, design and maintenance, internal nutrient cycling, unknown sources, and agriculture (including crop production and grazing practices). ADEQ, 2000. Discharges from dairy lagoons are likely to contain fecal coliform in concentrations greatly exceeding Arizona's water quality standards. Researchers evaluated the performance of a newly built integrated wastewater treatment facility at a 2000 cow dairy in Arizona. Karpiscak, 1999. The dairy's wastewater flow is collected in a collection sump, is pumped to solids separators, flows to anaerobic/facultative lagoons, flows to aerobic ponds, and then flows to surface wetland cells, where the wastewater can then be reused to flush barns or to irrigate crops. Concentrations of fecal coliform were measured in water samples taken from selected locations along the treatment system. The annual average concentration of fecal coliform measures at the outflow from the lagoons, at the outflow from the ponds, and at the outflow from the cells, measured in colony forming units (CFU) per 100 ml, was 1.39×10^6, 3.57×10^5, and 6.13×10^4, respectively. Karpiscak, 1999. Those concentrations would exceed the 4000 CFU per 100 ml single sample maximum for fecal coliform (the highest of the various maximum concentrations applicable to a water listed in Arizona's water quality standards) by over 300, 80, and 15 times, respectively. See R18-11-109.B, and R18-11, Appendix B.

ADEQ found that in 2000, 32 miles of the stream reaches assessed were impaired due to nutrients, 30 miles of the stream reaches assessed were impaired due to low dissolved oxygen, and 130 miles of the stream reaches assessed were impaired due to pathogens. ADEQ found that in 2000, 4,096 acres of lakes assessed were impaired due to low dissolved oxygen and 150 acres of lakes assessed were impaired due to pathogens. ADEQ identified grazing practices and crop production as probable sources of stressors impairing 407 and 132 miles, respectively, of stream reaches assessed in 2000. ADEQ identified grazing practices and crop production as probable sources of stressors impairing 175 and 386 acres, respectively, of lakes assessed in 2000. ADEQ, 2000. In west Maricopa County, several drinking wells have been inactivated due to excessive nitrate levels. Despite the concentration of CAFOs in west Maricopa County, some research has shown that while CAFOs contribute to the nitrate problem, they are not the major source. One ongoing study in west Maricopa County estimates that the primary nitrate inputs include human waste (40%), fertilizer (30%), animal wastes (15%), and natural/miscellaneous (15%). Of nitrate inputs from animal wastes, the study estimates that half are from CAFOs. USDA-NRCS, 1997.

Cryptosporidium oocysts have been detected in Phoenix-area canals used as raw drinking water supplies. In a 1995 study conducted by the City of Phoenix, raw water for the Squaw Peak Water Treatment Plant (the Arizona Canal) was found to contain detectable levels of *Cryptosporidium* on three out of six sampling events, and raw water for the Tempe South Water Treatment Plant (from the Tempe Canal) had detectable *Cryptosporidium* on one of three occasions. City of Phoenix Water Services Department, 1997.

C. Water Quality and BMP Implementation

For the most part, effective and acceptable practices are generally available for minimizing the impacts of agricultural animal wastes on the environment. Hoban, 1997; Pell, 1997. Once installed, many runoff control structures or farmstead improvements function as designed with few changes and with minimal management except for routine maintenance. Lanyon, 1994. Point sources of pollution from livestock operations can be minimized or eliminated by use of proper management systems which include selection of appropriate sites for

CAFOs, proper design of manure storage areas, waste water collection and application to croplands, and applying non-excessive rates of manure to croplands. Eghball, 1994. Several States now require that new animal facilities that exceed a certain size have an appropriate waste management plan. Sharpley, 1994.

According to USDA, a variety of animal waste management practices, generally referred to as best management practices (BMPs), are available to manage wastes and minimize their potential effects on water quality. USGAO, 1995. In general, the approaches encompassed by these BMPs include (1) minimizing the discharge of animal wastes by storing them until they can be used as fertilizer or to increase the organic content of soil, (2) preventing manure runoff from reaching surface waters, and (3) incorporating nutrient management practices when applying manure to cropland as a fertilizer. USGAO, 1995. To reduce agricultural runoff impacts, producers must implement additional, and often new, BMPs. Gannon, 1996.

BMP selection depends on site-specific factors such as soil composition and the proximity of an operation to surface water or groundwater. USGAO, 1995.

BMPs such as treatment lagoons, retention ponds, and other storage structures are used to store animal waste and prevent runoff from confined operations. USGAO, 1995. Irrigation equipment pumps liquid animal waste from the storage structures onto agricultural land. USGAO, 1995. Some confined operations -- especially poultry operations -- use composting systems to dispose of dead animals and manure. Composting reduces the volume and weight of waste and produces an end product that can be used as fertilizer. USGAO, 1995.

BMPs are essential for the effective use of beef cattle manure for crop production and pollution prevention. Eghball, 1994. There is a tremendous opportunity to improve the efficiency of recovery and use of nitrogen in beef feedlot manure. Eghball, 1994.

Several studies have investigated the long-term effectiveness of BMPs to reduce phosphorous export from agricultural watersheds, and water quality improvements have been demonstrated following BMP implementation in several areas. Sharpley, 2000; Edwards, 1996, and Edwards, 1997 (finding that in-stream concentrations of nitrogen species and chemical oxygen demand exhibited significant decreases concurrent with agricultural BMP implementation in Arkansas watershed with confined animal and other agricultural operations); Cook, 1996 (finding decreasing amounts of nitrate- and ammonium-nitrogen in surface waters in North Carolina watershed with confined animal operations); Epp, 1996 (analyzing cost-effectiveness of various BMPs used at animal operations in Pennsylvania

Vegetated filter strips and constructed wetlands remove nutrients and suspended solids from the runoff of confined operations. USGAO, 1995; Pell 1997, Safley, 1994. Filter strips and wetlands also serve as buffers between range or pastureland and surface water bodies; they perform a similar function for agricultural land to which manure has been applied as fertilizer. USGAO, 1995. At least one agricultural engineer has concluded that vegetative buffers should be implemented around all fields receiving waste. Safley, 1994.

Fencing restricts livestock access to surface water bodies, preventing animals from depositing wastes directly into these waters. USGAO, 1995.

D. Impacts of Land Application of Manure

At least some crop and soil science experts conclude that the infiltration rate serves as an upper limit upon the rate at which dairy manure may be land applied. Moore, 1997. Exceeding this rate results in runoff, which they consider as unacceptable. Moore, 1997.

The major portion of annual phosphorous loss in runoff generally results from one or two intense storms. Sharpley, 1994; Sharpley, 2000. If phosphorous applications are made during periods of the year when intense storms are likely, then the percentage of applied phosphorous lost would be higher than if applications are made when runoff probabilities are lower. Sharpley, 1994. The length of time between applying phosphorous and the first runoff event also influences phosphorous loss, especially in situations involving manure. Sharpley, 1994. For example, when simulated runoff was delayed from one hour to three days, researchers found a 90% reduction in phosphorous loss after poultry or swine manure was applied. Sharpley, 1994.

Application of manure to frozen soils often results in loss of organic bound nitrogen and phosphorous with snow melt runoff. Eghball, 1994.

E. Benefits of Nutrient Management

Some research indicates that incorporation of dairy manure into the soil reduced total phosphorous loss in runoff five-fold compared with areas receiving broadcast applications. Sharpley, 1994. Incorporation of manure after application greatly reduces runoff loss, and conserves manure nutrients and improves soil physical properties as compared to surface application. Eghball, 1994. Some researchers found no consistent differences in bacterial quality of runoff from manured and non-manured fields when the manure had been incorporated. Eghball, 1994.

Nutrient budgeting for farms and regions has been proposed as an approach to avoid nutrient loss to groundwaters and to surface waters when combined with soil and water conservation practices. Van Horn, 1994. For a farm to be sustainable, its nutrient budget must balance. Van Horn, 1994. If a net loss of nutrients occurs, the farms soils will eventually become depleted. Van Horn, 1994. Many agronomists and dairy extension specialists have developed nutrient budgeting materials for dairy farmers to use in planning the amount of crop production (or acreage) needed to use manure nutrients efficiently. Van Horn, 1994.

Nutrient management encompasses testing the nutrient content of soil, plant tissues, and manure to determine the proper timing and rates of application when applying manure as a fertilizer. USGAO, 1995. Fertilizer nutrients in manure are potentially recyclable through plants, thus avoiding excess nutrient losses to water and the atmosphere, if land applications are in balance with plant uptake. Van Horn, 1994. In Arizona, manure and wastewater from livestock facilities can be applied only at a rate that matches the uptake of nutrients by the crop. Moore, 1997. At least some crop and soil science experts predict that the use of the nutrient loading rate to limit the land application of dairy manure will soon become a requirement across the United States. Moore, 1997.

Diet or feed manipulation reduces the amount of waste generated by livestock or reduces the nutrient content of this manure. USGAO, 1995. Considerable progress may be made toward reducing nutrient concentrations on dairy farms through closer attention to ration balancing and feeding management. Grusnmeyer, 1997.

F. Cost Considerations for BMPs

EPA has estimated the range of investment costs for employing various BMPs for typical small- and medium-sized livestock confinement operations; these BMPs include the retention pond and irrigation system and vegetative filter strip options. USGAO, 1995. EPA's estimated investment and annual operations costs for use of various options are depicted in tables published in a U.S. General Accounting Office report, “Animal Agriculture: Information on Waste Management and Water Quality Issues”, GAO/RCED-95-200BR (1995). According to EPA's analysis, BMP investment costs vary by operation, depending on the BMP selected and the operation's size and type. USGAO, 1995. In addition, as operation size increases, total investment costs for a particular BMP generally increase; however, investment costs calculated on a per animal basis may decrease. USGAO, 1995. The type of operation -- e.g., dairy versus beef cattle -- will also affect costs; a dairy cow generally produces significantly more manure than a beef feedlot animal because dairy cows are usually larger and are fed a diet high in roughage. USGAO, 1995.

According to EPA, investment costs may also be greater if climatic conditions, such as periodically large storm water volumes or prolonged periods of subfreezing temperatures, require additional manure storage capacity. USGAO, 1995. Investment costs for manure storage capacity, for example, are significantly higher for operations in locations expected to experience high storm water volumes than in locations expected to experience low storm water volumes. USGAO, 1995. Similarly, storage costs are higher in northern states, which generally experience longer periods of subfreezing temperatures than other parts of the country; manure must be stored or longer periods of time to preclude its application to frozen cropland, from which it might easily be washed off into surface waters during thaws. USGAO, 1995.

EPA recently proposed revised NPDES permitting requirements and effluent limitations guidelines (ELGs) for CAFOs. As part of the rule-making process, EPA (2001) estimated compliance costs associated with the proposed rule. See, EPA, “Economic analysis for the proposed revisions to the National Pollutant Discharge Elimination System Permit Regulation and Effluent Guidelines for Concentrated Animal Feeding Operations” (2001). Cost estimates developed as part of the proposed rulemaking are included at the end of this section as Table A. Because requirements of the proposed rule are comparable to certain Arizona CAFO permit requirements, EPA Region 9 believes that the cost estimates developed in 2001 for the proposed rule are a good indicator of compliance costs associated with the permit.

EPA’s cost estimates for the proposed rule assume that CAFOs are in compliance with existing NPDES regulations. The costs associated with the revised rule include the incremental expense of new requirements such as nutrient management, run-on diversion, buffer strips, and discharge sampling. EPA’s cost estimate for the general permit that EPA is now issuing uses an assumption similar to that used in the proposed rulemaking: i.e., Arizona CAFO owners/operators are presumed to be compliance with the 1984 Arizona CAFO permit, including its requirements to contain all process generated wastewater and all runoff from storms less than the 25-year, 24-hour storm event.

EPA (2001) estimates start-up costs, which include nutrient management plan (NMP) training, NMP certification, and the purchase of sampling equipment, at $1,650 per facility. EPA Region IX estimates that the start-up costs associated with the Arizona general CAFO permit will be significantly lower than $1,650 per facility for most facilities. Lower costs for Arizona CAFOs are expected based on less expensive laboratory analysis costs and the ability of Arizona CAFO operators trained as 'certified nutrient management planning specialists' to approve their own nutrient management plans. EPA Region IX estimates that the greatest incremental costs for Arizona CAFOs under the general permit will be one-time capital costs associated with berms, buffer strips and, for new CAFOs, the cost for lining wastewater retention facilities.

One-time capital costs, which include the construction of berms, buffer strips, and wastewater control/retention facility liners (for new facilities), vary with facility size. The same pattern holds for annual operation and maintenance costs, record keeping, reporting, and certain nutrient management activities.

Few studies exist on the economic effects of environmental regulations in the livestock sector (MPCA 1999). As a result, little empirical data exists to estimate the economic effects of the permit on Arizona CAFOs. Although environmental regulations may have a substantial impact in certain circumstances, other factors play a more influential role in determining the scope and pace of change in the livestock sector (MPCA 1999). These may include capital costs, energy prices, government subsidies, interest rates, labor costs, and wholesale prices. EPA Region 9 believes these factors play a greater role in shaping the economic viability of Arizona CAFOs than environmental compliance costs. Permit compliance costs are likely to follow an economy of scale, with overall costs increasing with increasing facility size, while costs per animal unit decrease (EPA 2001).

EPA (2001) expects the revised CAFO NPDES regulations to be economically achievable for an overwhelming majority of livestock operations. Financial stress is expected at around ten percent of all dairy operations in the U.S. Beef operations are not expected to experience adverse effects. Although EPA anticipates some facility closures in the poultry and swine sectors, it does not foresee closures in the beef and dairy sectors (EPA 2001). Similarly, EPA Region 9 does not expect the general CAFO NPDES permit to have significant economic effects.

Liner Costs for new CAFOs:

The final Arizona general CAFO permit requires new CAFO operations to line waste-water retention facilities. This may or may not require a substantial capital cost to a new CAFO operation depending on the size of the retention facility, the type of soils available on site and surface topography. EPA (2001) estimates that wastewater control/retention facility liners cost $2.30/square foot on average. Costs may increase or decrease depending on whether they employ earthen or geosynthetic materials. If low permeability (e.g., high clay content) materials are present on site, CAFO owners/operators are likely to construct earthen liners. If low permeability materials are not present on site, CAFO owners/operators may have to import them from elsewhere or install geosynthetic liners, e.g., high-density polyethylene or polyvinyl chloride (Wright et al. 1999).

Nutrient Management Plan Costs:

EPA (2001) estimates the costs of CAFO nutrient management programs (see Table A at the end of this section). Start-up costs, which include training, certification, and equipment purchases, are estimated on a national level at $1,260. The Arizona general CAFO permit allows CAFO owners/operators or third party contractors who become approved 'certified nutrient management planning specialists' to approve nutrient management plans. EPA Region 9, NRCS, and the State of Arizona will provide technical assistance to help CAFO owners/operators or third party contractors become approved 'certified nutrient management planning specialists'. At this time there are no third party contractors in Arizona who have received NRCS approval as a "Certified Nutrient Management Planning Specialist" and therefore, a state specific cost estimate is not available. However, in Idaho, certified nutrient management planners charge $2,000-3,000 to prepare an NMP for 1,000 AU dairies (Mitchell 2000).

Annual operation and maintenance costs associated with NMPs, which include equipment calibration, disking, and record keeping, are estimated at national level to be approximately $980 + $10/acre. Periodic recurring costs, which include nutrient management plan revisions and soil testing, are estimated at $7/acre on a national level. Arizona Conservation Practice Code 590 requires soil sampling only every five years rather than the two to three years recommended under the proposed NPDES manure management guidance. Therefore, the annual cost per acre to implement nutrient management in Arizona should be significantly lower than $7 an acre.

By using manure as a resource, CAFO owners/operators may reduce the need for commercial fertilizers and increase crop yields. At a minimum, these benefits will provide a partial offset of the costs of implementing nutrient management. In some instances, nutrient management may result in overall cost savings to CAFO owners/operators (MPCA 2000; WNDR).

Costs for berms and stormwater management:

The permit requires CAFO owners/operators to isolate open lots and associated wastes from outside surface drainage by ditches, dikes, berms, terraces or other wastewater control or retention structures, designed to carry, store or contain peak flows during the 25-year, 24-hour storm event; and to protect any waste water control or retention structure by berms or other appropriate structures to prevent inundation that may occur during a 25-year, 24-hour storm event. These provisions do not differ dramatically from the 1984 Arizona CAFO permit, which requires permittees to contain all process generated wastewater and all runoff from storms less intense than the 25-year, 24-hour storm event.

Like other capital improvements, the cost of constructing ditches, dikes, berms, terraces and other surface runoff control structures varies according to facility size. Average berm construction costs have been estimated at $2.30/linear foot and $2.60/cubic foot, respectively (Wright et al. 1999; EPA 2001). The creation and maintenance of buffer strips will typically not require CAFO owners/operators to substantially restructure their operations. Structural changes associated with buffer strips will typically be limited to areas near feedlots, manure storage areas, land application areas, and waters of the U.S. Wright et al. (1999) estimate the average cost of creating and maintaining buffer strips at $2,700/each. Like other capital improvement items, these costs should vary based on facility size.

Table A.
Estimated compliance costs associated with the proposed NPDES permitting requirements and ELGs for CAFOs (Source: EPA 2001).

Cost Type	Item	Cost
Start-Up Costs	Training and Certification for Manure Application	$120
	Owner/Operator Nutrient Management Planning Training	$580
	Initial Costs for Surface Water Sampling	$390
	Initial Costs for Manure Sampling	$560
One-Time Capital Costs	Wastewater Control/Retention Facility Liner	$2.30/square foot
	Berm Construction (Run-On Diversion)	$2.60/cubic foot
	Buffer Strips	$110/acre
Annual Operation and Maintenance Costs	Manure Testing	$50/sample
	Record keeping and Reporting	$880
	Calibration of Manure Spreader	$100
	Surface Water Sampling	$130/sample
	Visual Inspections	$130
	Disking (Nutrient Management)	$10/acre
Periodic Recurring Costs	Nutrient Management Plan Development (once every 3 years)	$5/acre
	Soil Testing (once every 3 years)	$2/acre

Compliance with the permit may also lead to the avoidance of costs that would otherwise be borne by CAFO owners and operators, or neighboring property owners. Compliance with the permit should substantially reduce the risk of spills from a CAFO's lagoons or other waste treatment structures. Compliance should therefore also reduce the risk of cleanup costs, or liability to downstream property owners or others affected by such spills. Spill prevention and other water quality improvements resulting from permit compliance may lead to other benefits, such increased value of neighboring properties in the vicinity of a CAFO. See, e.g.: Leggett, 2000 (analyzing the effects of water quality on residential land prices in Chesapeake Bay area; indicating that higher levels of fecal coliform significantly depress property values, and estimating that a change of 100 fecal coliform counts per 100 ml produced about a 1.5% change in property prices); and Magat, 2000 (reporting results of surveys in Colorado and North Carolina indicating that respondents were willing to pay an average of $22.40 in increased annual cost of living for a one-percent improvement in the level of surface water quality).

IV. DEVELOPMENT OF NATIONAL CAFO PERMITTING STRATEGY

A. Clean Water Action Plan

On February 14, 1998, President Clinton released the Clean Water Action Plan (CWAP) which provided a list of actions to be taken to support existing efforts to restore the Nation's waters to "fishable and swimmable" status. The CWAP identified discharges from animal feeding operations (AFO's) as a significant environmental and public health concern. Impacts identified in the CWAP included nutrient enrichment of surface and ground waters, contamination of water supplies, fish kills and odors. The CWAP identified the need for both EPA and the U.S. Department of Agriculture (USDA) to develop a joint, unified strategy. The purpose of this joint strategy would be to refocus the federal government's technical, financial and programmative efforts more effectively to address the environmental and public health issues associated with AFO's. The EPA/USDA National AFO Strategy would have the following goals, as stated in the CWAP:

- Coordinate program and interagency cooperation
- Develop and implement comprehensive management systems for AFO's
- Revise and strengthen existing permit regulations
- Provide incentives to enhance environmental protection
- Develop a coordinated plan for research
- Develop watershed nutrient budgets
- Target activities to priority watersheds
- Encourage establishment of a certification program

The need for strengthening existing permit requirements for CAFO's is well documented. According to ERS’s analysis of 1992 Census of Agriculture data, about 6,600 operations in the livestock and poultry sectors examined by USGAO (generally, beef cattle on feedlots, dairy cows, hogs, broilers, layers and turkeys, but excluding beef cattle not on feedlots) had more than 1,000 animal unit equivalents. USGAO, 1995. As of April 1995 approximately 1,987 CAFOs in the livestock and poultry sectors examined by USGAO had NPDES permits. USGAO, 1995.

B. EPA/USDA Unified National Strategy for Animal Feeding Operations

The joint EPA/ USDA Unified National Strategy for Animal Feeding Operations (Unified Strategy) was published on March 9, 1999. In developing the Unified Strategy, the goal of the USDA and EPA was for AFO owners and operators to take actions to minimize water pollution from confinement facilities and the land application of manure. Major issues addressed in the Unified Strategy include building capacity to implement Comprehensive Nutrient Management Plans (CNMPs) and improving existing regulatory programs.

The Unified Strategy refers to a two-phase approach to the NPDES permitting of CAFOs. The first permitting priority is to issue statewide general and major individual (over 1,000 AUs) NPDES permits for CAFOs. The second phase, to start by 2005, would require the re-issuance of general permits for CAFO's over 1,000 AUs.

The Unified Strategy refers to a comprehensive NPDES permitting guidance and a model permit to be developed by EPA. Under this guidance, NPDES permits for CAFO's would require the development of a CNMP and its implementation on a schedule established in the permit. The CNMPs would be developed by a certified specialist, a qualified State agency official or by the National Resource Conservation Service (NRCS).

C. Comprehensive Nutrient Management Plans

The joint EPA/USDA Unified National Strategy for Animal Feeding Operations (Unified Strategy) is based on a national performance expectation that all AFO's should develop and implement technically sound, economically feasible, and site-specific Comprehensive Nutrient Management Plans (CNMPs). The Unified Strategy defined a CNMP as actions or priorities that will be followed to meet clearly defined nutrient management goals at an agricultural operation. The USDA and EPA agree that CNMPs should address the following as necessary:

- feed management,
- manure handling and storage,
- land application of manure,
- land management,
- record keeping,
- other utilization options, i.e., off-site application, composting, power generation.

The national NRCS technical guidance for comprehensive nutrient management plans (CNMPs) was finalized on December 1, 2000. The CNMP guidance document states that although NRCS has traditionally been the main provider of conservation planning assistance, the development of CNMPs presents a workload beyond the capabilities of the agency. In order to increase the capacity to develop CNMPs, NRCS will establish a process for certifying approved sources of conservation assistance. An individual who is appropriately certified through an USDA-recognized certification organization is referred to either as a “certified specialist” or a “certified conservation planner”.

V. PERMITTING OF AFO AND CAFO OPERATIONS IN ARIZONA

A. Arizona AFO and CAFO Operations

In Arizona, there is a total of approximately 177 animal feeding operations (AFOs) and 97* CAFOs. The number of AFOs by type is estimated as follows:

Dairy	136 **
Beef	27 **
Swine	7 ***
Poultry	5 ****
Ostrich	7

* AZ Department of Environmental Quality, March 2001
** AZ Department of Ag. '99

*** AZ Department of Ag. '97
**** AZ Department of Ag. '98

At the present time, in Arizona the number of dairies is increasing, hog operations are decreasing and the number of poultry and beef operations are remaining static. Approximately 70 percent of Arizona's CAFOs are located in west Maricopa County. According to the ADEQ's CAFO Database (August 15, 2000) there are 101 dairies in Maricopa County, 7 feedlots, one swine facility and two poultry facilities.

B. State of Arizona AFO/CAFO Permitting Requirements

Arizona law requires the ADEQ to adopt a permit requirement for point sources and for certain facilities likely to pollute aquifers, and a "program to control non-point source discharges of any pollutant or combination of pollutants into navigable waters." Ariz. Rev. Stat. Ann. § 49-203.A (West 1997). Its general prohibition law makes it a criminal offense to discharge (with criminal intent) substances to waters without a required permit or other "appropriate authority", or to violate a water quality standard. Ariz. Rev. Stat. Ann. § 49-263.A. Arizona has provided for the development of agricultural general permits for "regulated agricultural activities," defined as "application of nitrogen fertilizer or a [CAFO]." Ariz. Rev. Stat. Ann. §§ 49-247, -201.29 (West 1997).

Arizona specifically makes BMPs enforceable in a general permit applicable to "regulated agricultural activities," which are defined as the application of nitrogen fertilizer and CAFOs Ariz. Rev. Stat. Ann. §§ 49-247, -201.29 (West 1997).

ADEQ currently tracks compliance with Arizona statutes using a CAFO database. Violations of the agricultural general permit are assigned either a Notice of Opportunity to Correct (NOC) or Notice of Violation (NOV). As of August 15, 2000, ADEQ's CAFO database shows that since 1997, 33 dairies and five feedlots have received an NOC or equivalent warning of potential violations. ADEQ issued NOV's to two dairies in 1998 and 1999 related to unauthorized discharges of wastes.

VI. ARIZONA GENERAL NPDES PERMIT FOR CAFOs

A. Introduction

In 1984 EPA Region 9 issued a general NPDES permit authorizing the discharge of pollutants from feedlots in existence in Arizona at the time the permit was issued. 49 FR 40441, Oct. 16, 1984. That permit expired five years after its issuance. *Id.* Like the previous general permit, this permit will make available to CAFO owners or operators a streamlined process for obtaining coverage. The proposed general permit is designed to reduce the total reporting and monitoring burden that would otherwise be created if each of the subject CAFO owners or operators were required to obtain individual NPDES permits.

EPA believes that offering the option of coverage under this proposed general permit will be economically beneficial to the regulated community, as compared to the administrative expense of requiring individual permit applications from each CAFO. It provides an economic alternative to the individual application and permitting process the facilities covered by this permit would otherwise have to face.

An economic analysis was done when the BAT requirements for the national effluent guidelines (40 CFR 412) were published. Region 9 believes that a similar economic and technology rationale would apply to the smaller facilities covered by this permit. Also, Region 9 believes that, for most smaller facilities, this permit represents a more economical option than obtaining an individual permit.

B. Application for Coverage

An owner or operator of a CAFO eligible for coverage under the general permit may apply for an individual permit rather than seek coverage under the general permit. Consequently, an owner or operator who believes that the provisions of the general permit would be inappropriate with respect to its CAFO may apply for an individual permit.

C. Requirement to Develop a Best Management Practices (BMP) Plan

The BMP plan and Minimum Standards included in the permit address compliance with both the technology based effluent limitation guidelines (ELGs) for feedlots at 40 CFR 412 and compliance with surface water quality standards. The permit conditions requiring the development of a BMP Plan preparation are designed to abate or control the discharge of pollutants, and to achieve compliance with 40 CFR 412, and are authorized by CWA, secs. 402(a)(1), 308(a), 304(e), and 501(a), and 40 CFR 122.43 and 122.44(k). The permit requires that the BMP Plan must demonstrate that the CAFO's wastewater control or retention structures are adequately designed in accordance with NRCS Conservation Practice Standard Code 313 for Waste Storage Facilities or any subsequent NRCS revision of Standard 313 which the permittee references in the BMP Plan.

D. Regulatory Basis for the Nutrient Management Plan (NMP)

The NMP plan addresses the requirement of 40 CFR 122.44(d) applicable to compliance with State surface water quality standards. NMPs will improve surface water quality by reducing the discharge of nutrients and pathogens from land application areas by implementation of proper management techniques. The permit conditions requiring the development of an NMP are authorized by CWA, secs. 402(a)(1), 308(a), 304(e), and 501(a), and 40 CFR 122.43 and 122.44(k). The NMP establishes the rates at which manure or waste-water can be land applied so as to meet crop nutrient needs while minimizing the amount of pollutants discharged in agricultural return flows.

E. Development of an NMP Under the NPDES Permit

The general NPDES permit for CAFOs requires the permittee to develop and obtain an approved nutrient management plan (NMP) within two years of permit issuance, or within thirty days before beginning land application, whichever is later. For guidance in establishing NMPs, the permit refers to NRCS Conservation Practice Standard 590 for Arizona.
To comply with the requirements of the Arizona general permit for CAFOs, an NMP plan must

provide that waste, process waste water and soil sampling shall be conducted in accordance with the most current version of NRCS Conservation Practice Standard - Arizona Nutrient Management, Code 590, and must contain the following minimum information: a Field Map, Soil Test Results, Crop Sequence, Realistic Yield Goals, Manure and Waste Water Nutrient Values, Recommended Application Rates, Recommended Application Methods, and Guidance for implementation, operation, maintenance and record keeping.

F. Approval of NMP Plans Under the Permit

An approved NMP plan as required by the permit must be developed either by Arizona NRCS or by a "Certified Nutrient Management Planning Specialist". A CAFO operator or other third party vendor who has completed the following training may qualify as a "Certified Nutrient Management Planning Specialist" with the ability to plan or approve NMPs:

1. The following NRCS web-based classes, located at **http://www.ftw.nrcs.usda.gov/nedc/homepage.html,** must have been completed and passed by a person training to be a Certified Nutrient Management Planning Specialist prior to that person undertaking the training described in subsection 2 below:

    a. "Introduction to Water Quality",
    b. "Nutrient Management Consideration in Conservation Planning", and
    c. "Agricultural Waste Management Systems - A Primer".

2. The following NRCS-Arizona 1-day Nutrient Management Training Course must have been completed and passed by a person training to be a Certified Nutrient Management Planning Specialist prior to that person being eligible to obtain approval by the NRCS as a Certified Nutrient Management Planning Specialist:

    a. Conservation Planning Course Modules 1-5
    b. Federal Regulations
    c. Arizona Regulations
    d. "Arizona Nutrient Management Considerations in Conservation Planning."

G. Requirements to Develop a CNMP

The public noticed version of Arizona's general permit included the requirement to develop a CNMP plan in accordance with the Unified Strategy. Because the training programs for 'certified specialists' and 'certified conservation planners' are not yet available in Arizona, the EPA determined that the inclusion of a provision to require development of CNMPs in the final permit was premature. To be consistent with current EPA NPDES policy this provision was removed from the final permit.

H. Definition of Discharge

The draft general permit includes definitions for the terms "discharge" and "discharge of a pollutant". The definitions are derived from the definitions for those terms found at 40 CFR

122.2. A discharge means any addition of any pollutant or combination of pollutants to waters of the United States from any point source. This definition includes additions of pollutants into waters of the United States from: surface water runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances owned by a State, municipality, or other person which do not lead to a treatment works; and discharges through pipes, sewers, or other conveyances leading into privately owned treatment works.

I. Federal Acts Applicable to CAFO permitting

40 CFR 122.49 lists federal laws that may apply to the issuance of NPDES permits. Federal laws that apply to the issuance of this permit include the Endangered Species Act and the National Historic Preservation Act.

The Endangered Species Act and implementing regulations require the Regional Administrator to ensure, in consultation with the Secretary of the Interior or Commerce, that any action authorized by EPA is not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat. The permit provides that CAFOs which are likely to adversely affect a listed or proposed to be listed endangered or threatened species or its critical habitat are ineligible for coverage under the permit. An owner or operator of a CAFO which is likely to adversely affect a listed or proposed to be listed endangered or threatened species or its critical habitat, and thus ineligible for coverage under the general permit, may apply for an individual permit. 40 CFR 122.49 provides that, when the Endangered Species Act requires consideration or adoption of particular permit conditions or requires the denial of a permit, those requirements must be followed.

EPA may determine that a CAFO is ineligible for coverage because the CAFO is likely to adversely affect a listed or proposed to be listed endangered or threatened species or its critical habitat, or is likely to adversely affect properties listed or eligible to be listed in the National Register of Historic Places. If EPA makes such a determination, it may advise the owner or operator of the CAFO to seek an individual NPDES permit.

The National Historic Preservation Act (NHPA) and implementing regulations require the Regional Administrator, before issuing a permit, to adopt measures when feasible to mitigate potential adverse effects of the permitted activity on properties listed or eligible for listing in the National Register of Historic Places. The Act’s requirements are to be implemented in cooperation with State Historic Preservation Officers and upon notice to, and when appropriate, in consultation with the Advisory Council on Historic Preservation. The proposed permit provides that CAFOs which are likely to adversely affect properties listed or eligible to be listed in the National Register of Historic Places are ineligible for coverage under the permit. An owner or operator of a CAFO which is likely to adversely affect properties listed or eligible to be listed in the National Register of Historic Places, and thus ineligible for coverage under the permit, may apply for an individual permit. 40 CFR 122.49 provides that, when the National Historic Preservation Act requires consideration or adoption of particular permit conditions or requires the denial of a permit, those requirements must be followed.

J. Description of procedures for reaching a final decision on the draft permit:

On September 5, 2000, EPA published a Federal Register notice of the draft general NPDES permit and request for comments. A public hearing on the draft general permit was held at the offices of the Arizona Department of Environmental Quality on October 12, 2000. On October 20, 2000, EPA published a notice which extended the public comment period until November 20, 2000. Upon the close of public notice and prior to final publication of the permit, EPA prepared a document responding to all comments received. The public record, including EPA's responses to comments received on the noticed permit, is located at EPA Region 9, and is available upon written request. Requests for copies of the public record should be addressed to Shirin Tolle or Jacques Landy at the addresses below . A reasonable fee may be charged for copying.

K. Name and telephone number of person to contact for additional information:

Shirin Tolle, CWA Standards & Permits Office (WTR-5), EPA Region 9, 75 Hawthorne Street, San Francisco, CA 94105-3901; tel. 415 744-1898.

Jacques Landy, CWA Standards & Permits Office (WTR-5), EPA Region 9, 75 Hawthorne Street, San Francisco, CA 94105-3901; tel. 415 744-1922.

L. Finding of No Significant Impact:

Pursuant to CWA, section 511(c), and 40 CFR Part 6, EPA has conducted an environmental review of the proposed action, and has determined that no significant impacts are anticipated. Interested persons disagreeing with the decision may submit comments to Shirin Tolle or Jacques Landy, CWA Standards & Permits Office (WTR-5), EPA Region 9, 75 Hawthorne Street, San Francisco, CA 94105-3901.

The proposed permit requires that a person seeking coverage for a new CAFO must submit to EPA, and to the State or Indian Tribe, as appropriate, an Environmental Information Document (EID), containing the information identified in Appendix C, no later than 90 days before the operation becomes a CAFO. This requirement will provide EPA an opportunity to conduct an environmental review, determine if any significant impacts are anticipated, determine if an environmental impact statement is required and otherwise ensure compliance with NEPA requirements, with respect to the proposed new source.

VI. REFERENCES

Arizona Department of Environmental Quality, 2000. "The Status of Water Quality in Arizona, Clean Water Act Section 305(b) Report 2000" (ADEQ EQR-00-03)

Barry, R., 1998. "Agricultural Phosphorous and Water Quality: A U.S. Environmental Protection Agency Perspective", 27 J. Environ. Qual. 258 (1998).

Burkholder, J.M., et al, 1997. "Impacts to a Coastal River and Estuary from Rupture of a Large Swine Waste Holding Lagoon", J. Environmental Quality, vol. 26, 1451.

City of Phoenix Water Services Department, 1997. "Study to Develop BCT for NPDES Permit

Limits with January, 1997 Amendments."

Cook, M.G., Hunt, P.G., Stone, K.C., and Canterberry, J.H., 1996. "Reducing Diffuse Pollution Through Implementation of Agricultural Best Management Practices: A Case Study", Water Science Technology, vol. 33, 191.

Copeland, C., and Zinn, J. 1998. Congressional Research Service Report for Congress, No. 98-451, "Animal Waste Management and the Environment: Background for Current Issues" (May 12, 1998).

Davis, J., Young, M., and Ahnstedt, B., 1997. "Soil characteristics of cropland fertilized with feedlot manure in the South Platte river basin of Colorado", J. of Soil and Water Conservation, 327 (Sept./Oct. 1997).

Edwards, D.R., et al. 1996. "Stream Quality Impacts of Best Management Practices in a Northwestern Arkansas Basin", Water Resources Bulletin, vol. 32, 499.

Edwards, D.R., et al. 1997. "Effect of BMP Implementation of Storm Flow Quality of Two Northwestern Arkansas Streams", Transactions of the ASAE, vol. 40, 1311.

Eghball, B., Power, J.F. 1994. "Beef cattle feedlot manure management", J. of Soil and Water Conservation, 113 (Mar./Apr. 1994).

Epp, D.J., and Hamlett, J.M., 1996. "Cost-effectiveness of Conservation and Nutrient Management Practices in Pennsylvania", J. of Soil and Water Conservation, vol. 51, 486.

Gannon, R.W., Osmond, D.L., Humenik, J.A., Gale, J.A., and Spooner, J., 1996. "Goal-Oriented Agricultural Water Quality Legislation", Water Resources Bulletin, vol. 32, 437.

Garber, L., Wells, S., Schroeder-Tucker, L., and Ferris, K., 1999. "Factors Associated with Fecal Shedding of Verotoxin-Producing *Escheria coli* O157 on Dairy Farms", J. of Food Protection, vol. 62, no. 4, 307 (1999).

Gollehon, N, and Caswell, M., "Confined Animal Production Poses Manure Management Problems", Agricultural Outlook, AGO-274, 12 (Sept. 2000).

Grover, T., 1996, "Livestock Manure: Foe or Fertilizer?", in Agricultural Outlook, USDA/Economic Research Service, June 1996.

Grusnmeyer, D.C., and Cramer, T.N., 1997. "Manure Management: A Systems Approach", J. Dairy Science, vol. 80, 2651.

Hart, J.M., Marx, E.S., Christensen, N.W., and Moore, J.A., 1997, "Nutrient Management Strategies", J. Dairy Science, vol. 80, 2659.

Hoban, T., Clifford, W., Futreal, M., and McMillan, M., 1997. "North Carolina producers' adoption of waste management practices", J. of Soil and Water Conservation, 332 (Sept./Oct.

1997).

Karpiscak, M.M., et al,1997. “Management of Dairy Waste in the Sonoran Desert Using Constructed Wetland Technology”, Water Sci. Tech., vol. 40, 57 (1999).

Lanyon, L.E.. 1994. “Dairy Manure and Plant Management Issues Affecting Water Quality and the Dairy Industry”, J. Dairy Science, vol. 77, 1999.

Leggett, C.G., and Bockstael, N.E., 2000. “Evidence of the Effects of Water Quality on Residential Land Prices”, J. of Environmental Economics and Management, vol. 39, 121 (2000).

Magat, W.A., Huber, J., and Viscusi, W.K., 2000. “An Iterative Choice Approach to Valuing Clean Lakes, Rivers, and Streams”, Harvard John M. Olin Discussion Paper No. 295 (Aug. 2000).

McFarland, A.M.S., and Hauck, L.M., 1999, “Relating Agricultural Land Uses to In-Stream Stormwater Quality”, J. Environmental Quality, vol. 28, 836 (1999).

Ogg, C., 1999. “Benefits from Managing Farm Produced Nutrients”, J. of the American Water Resources Association, vol. 35, no. 5, 1015 (Oct. 1999)

Parsons, R.L., Pease, J.W., and Bosch, D.J., 1995. “Simulating Nitrogen Losses from Agricultural Land: Implications for Water Quality and Protection Policy”, Water Resources Bulletin, vol. 31, 1079.

Pell, A., 1997. “Manure and Microbes: Public and Animal Health Problem?”, J. Dairy Science, vol. 80, 2673.

Safley, L.M., 1994. “Best Management Practices for Livestock Production”, J. of Soil and Water Conservation, vol. 49 (supplement), 57.

Sharpley, A., Foy, B., and Withers, P., 2000. “Practical and Innovative Measures for the Control of Agricultural Phosphorous Losses to Water: An Overview”, J. of Environmental Quality, vol. 29, 1.

Sharpley, A.N., Chapra, S.C., Wedepohl, R., Sims, J.T., Daniel, T.C., and Reddy, K.R. 1994. “Managing Agricultural Phosphorous for Protection of Surface Waters: Issues and Options”, J. Environmental Quality, vol. 23, 437.

Sims, J.T., Edwards, A.C., Schoumans, O.F., and Simard, R.R., 2000. “Integrated Soil Phosphorous Testing into Environmentally Based Agricultural Management Practices”, J. Environmental Quality, vol. 29, 60.

Sweeten, J.M., and Wolfe, M.L.. 1994. “Manure and Wastewater Management Systems for Open Lot Dairy Operations”, Transactions of the American Society of Agricultural Engineers, vol. 37, 1145.

Thurow, A.P., and Holt, J. 1997. "Induced Policy Innovation: Environmental Compliance Requirements for Dairies in Texas and Florida", J. of Agricultural and Applied Economics, vol. 29, 17.

Trachtenberg, E., and Ogg, C.. 1994. "Potential for Reducing Nitrogen Pollution through Improved Agronomic Practices", Water Resources Bulletin, vol. 30, 1109.

U.S. Department of Agriculture, Natural Resources Conservation Service. 1997. "Watershed Plan and Environmental Assessment for West Maricopa Watershed"

U.S. General Accounting Office. 1995. "Animal Agriculture: Information on Waste Management and Water Quality Issues", GAO/RCED-95-200BR.

Van Horn, H.H., Wilke, A.C., Powers, W.J., and Nordstedt, R.A. 1994. "Components of Dairy Manure Management Systems", J. Dairy Science, vol. 77, 2008.

Wesley, I.V, et al, "Fecal Shedding of *Campylobacter* and *Arcobacter* spp. in Dairy Cattle", Applied and Environmental Microbiology, vol. 66, no. 5, 1994 (2000).

References on Cost

Bennett, M., D. Osburn, C.D. Fulhage, and D.L. Pfost. 1994. Economic considerations for dairy waste management systems. University of Missouri Extension Water Quality Initiative Publication WQ302. Columbia, MO.

Lyon, R.M. and S. Farrow. 1995. An economic analysis of Clean Water Act issues. Water Resources Research 31(1): 213-223.

Minnesota Pollution Control Agency (MPCA). 1999. Statement of need and reasonableness: amendments to Minnesota rules relating to animal feedlots, storage, transportation, and utilization of animal manure. Minneapolis, MN.

Mitchell, M. 2000. Idaho Department of Agriculture. Personal Communication.

U.S. Environmental Protection Agency (EPA). 2001. Economic analysis for the proposed revisions to the National Pollutant Discharge Elimination System Permit Regulation and Effluent Guidelines for Concentrated Animal Feeding Operations. Washington, DC. January, 2001.

Wisconsin Department of Natural Resources (WDNR). Small Business Analysis Associated with the Redesign of Nonpoint Source Pollution Programs. Madison, WI.

Wright, P., W. Grajko, D. Lake, S. Perschke, J. Schenne, D. Sullivan, B. Tillapaugh, B. Timothy, and D. Weaver. 1999. Earthen manure storage design considerations. Natural Resource, Agriculture, and Engineering Service Cooperative Extension Report No. 109. Ithaca, NY.